

Prevalence of Diabetic Nephropathy among Type 2 Diabetes Mellitus Patients in Mukalla City, Yemen

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Abstract: Diabetic nephropathy is one of the most serious complication of diabetes mellitus, which is clinical syndrome characterized by relentless albuminuria leading cause of kidney failure and subsequent dialysis, and it's major cause of premature death in patients with diabetes: In Mukalla City-Yemen there is no previous published studies about prevalence of diabetic nephropathy among type 2 diabetic patient, The study aimed to determine the prevalence of diabetic nephropathy and risk factor among type 2 diabetic patients in Mukalla city, Yemen. A cross sectional study conducted among 127 medically diagnosed patients with type 2 DM, in five health centers which provide health care for diabetic mellitus patients in Mukalla city, Yemen during (1 March to 30 April 2020). Data was collecting by interview (face to face) by using questionnaire and laboratory investigation (microalbuminuria test and serum creatinine test). We found that 43 of patients had diabetic nephropathy giving prevalence (33.9 %). The results show there was statistical significant association between diabetic nephropathy, duration of DM and hypertension, while there is no statistical significant association between diabetic nephropathy, age and gender, and the level of serum creatinine in all type 2 DM patients was normal, the prevalence of diabetic nephropathy among type 2 DM patients was high, and microalbuminuria test was more reliable for detecting early stages of diabetic nephropathy than serum creatinine.

Keywords: Diabetes Mellitus Type 2, Diabetic Nephropathy, Microalbuminuria, Mukalla City-Yemen

1. Introduction

Diabetes Mellitus (DM) is a group of metabolic diseases characterized by hyperglycemia resulting from defect in insulin secretion, insulin action or both, globally in 2014 there were 422 million adults had got diabetes,[1] the type 2 diabetes is the most common type of the disease, affecting approximately

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90% of the diabetic population,[2] People with diabetes are at increased risk of chronic complications which affect many organ systems and are responsible for the majority of morbidity associated with the disease,[3]

Diabetic nephropathy is a clinical syndrome characterized by relentless albuminuria which is the leading cause of kidney failure and subsequent dialysis.[4] Which is major cause of premature death in patients with diabetes, related to cardiovascular disease it's occurs in about 30-40% of patients with type 1 DM, [5] and 25-40 % of patients with type 2 DM,[6] and it's a public health disease concern of increasing proportions of and reasons for a significant lead to death, especially if there is no intervention in type 2 diabetic patients, 20-40% with microalbuminuria progress to manifested nephropathy; approximately 20% develop end-stage renal disease (ESRD).[7]

Microalbuminuria is considered to be an early marker of diabetic nephropathy and predictor of cardiovascular disease, [8] the early detection of microalbuminuria in the course of the disease is important because the progression of diabetic nephropathy from proteinuria to renal failure is irreversible.[9] The American Diabetes Association (ADA) recommends all type 2 diabetic patients should do annual microalbuminuria urine test,[10] according to the ADA when using the, 24-hour collection technique, albumin excretion <30 mg/24 hour is considered normal, 30-299 mg/24 hour indicates microalbuminuria, and 300 mg or higher indicates macroalbuminuria, the routine laboratory tests can't detect these small amounts of albuminuria 30-300mg/day unless it is in excess of 300 mg/day, that is distinctly abnormal, This range (30-300 mg/day) referred to as microalbuminuria.[11]. Several studies have shown an alarming high prevalence of diabetic nephropathy in types 2 DM patients, for examples in the United Kingdom the prevalence of nephropathy was 30.8% , while in Mexican Americans was 31%,[12] moreover, studies conducted in Asian Countries reported variability in the prevalence rate of microalbuminuria ranging from 14.2% in Iran, 24.2% in Pakistan, to 36.3% in India, in Arab Countries a studies conducted on type 2 diabetic patients attending the diabetic center of Baghdad, Iraq, showed the prevalence of microalbuminuria among type tow diabetic patients was 16.1% During 2013,[13] in Kuwait was 43.3%,[14] in United Arab Emirates was 61.2% 43.3%,[15] In Oman, was 54.3%, [16] in Saudi Arabia,was 54.3%, [17] in Bahrain was 27,8%[18] In Sana'a City Yemen was 33.6% [19]

In Mukalla City Yemen, there is no previous published studies about prevalence of diabetic nephropathy among type 2 DM patients.

The objectives of this study were to determine the prevalence of diabetic nephropathy among type 2 DM patients Mukalla City Yemen. To identify association between diabetic nephropathy and the following factors (age, gender, duration of DM, and hypertension) of type 2 diabetic patients. To determine the association between serum creatinine and diabetic nephropathy.

2. Materials and method:

This is a cross sectional analytical study, was performed in health centers which provide health care for diabetic patients in Mukalla city, the target population of this study was all adults both males and females with type 2 DM defined according to ADA [20] these patients attending to health centers during the period (from 1 March to 30 April 2020) Inclusion criteria; Medically Diagnosed type 2 diabetes mellitus patients. Exclusion criteria; Type 1 DM, or Any one of the participants who suffered from, gestational diabetes, thyroid problems, obstructive liver disease, advanced renal failure, and tuberculosis Sample size: The sample size was calculated by using the following formula:

$$N = \frac{(Z)^2 Pq}{(d)^2}$$

The sampling method was purposive sampling method for all health centers, which provide health care for diabetic patients, and we were took the sample size (127) patients from these centers by using

the convenience-sampling method. The samples were distributed proportionally among the health centers according to total number of patients who attended the all health centers in last three month (flow rate) as the following formula $X = n \times x / N$

3. Data collection and tools

Interview (face to face) by using questionnaire: the patient was provided with prepared oriented questionnaire with a set of questions divided into three main sections: 1st - personal data. 2nd –Socio-demographic (age, gender). 3th – Clinical characteristic (duration of DM, hypertension). Laboratory investigation (microalbuminuria test and serum creatinine test): A) Microalbuminuria test. [19] Normal < 30 mg \ 24. Microalbuminuria 30 -300 mg\24. Macroalbuminuria > 300 mg \ 24. B) Serum creatinine Normal range Adult Male: 0.9–1.3 mg/dl Adult Female: 0.6–1.1 mg/dl. [32]

Ethics approval: A permission was taken from management of authority of the including health centers, and then we took the patients consent to participate or to withdraw. We had certainly maintained the security and privacy of data and used only for research purposes.

Data Analysis: The data was analyzed by using statistical package for social science (SPSS v24) the obtain data was analyzed by using descriptive statistical tools (Frequencies, percentage, mean and standard deviation) and inferential statistical tool by used (Chi-square test). The results of simple logistic regression analysis were recorded as beta, p-value, and 95% confidence interval.

4. Results and Discussions

In our samples we studied 127 patients, their ages ranged from (40-70) years with mean.Age was (52.18), the sample was divided into three groups (40-50), (51-60) and (>60) years, while gender distribution shows that (53.5%) were males and (46.5%) were females. (**Table 1**).

Table 1: Distribution of socio-demographic characteristics of participants

Characteristic	Frequency	Percentage
Age	40-50	55
	51-60	54
	>60	18
Total	127	100
Gender	Male	68
	Female	59
Total	127	100

The prevalence of diabetic nephropathy among type 2 DM patients was 33.9% (**Table 2**)

Table 2: Prevalence of diabetic nephropathy among type 2 DM patients

Diabetic Nephropathy	Frequency	Percentage
Yes	43	33.9
No	84	66.1
Total	127	100

In our study the diabetic nephropathy is more common in age groups 51-60 (15%) followed by 40-50 and >60 ;(12.6%),(6.3%) respectively. There was no significant association between age group and diabetic nephropathy with p- value 0.472. (**Table 3**).

Table 3: The association between age and prevalence of diabetic nephropathy

Age (Years)	Nephropathy		No nephropathy		Total		Chi-square	P-value
	No.	%	No.	%	No.	%		
40-50	16	12.6	39	30.7	55	43.3	1.501	0.472
51-60	19	15.0	35	27.5	54	42.5		
> 60	8	6.3	10	7.9	18	14.2		
Total	43	33.9	84	66.1	127	100		

Chi-square test used for statistical significant, level of significant is 0.05

The frequency of males were 68 (53.5%), of these 26 (20.5%) had nephropathy while 42 (33.0%) had not. And the frequency of females were 59 (46.5%), of these 17 (13.4%) had nephropathy and 42 (33.1%) had not, so the males are more affected by nephropathy than females, but there was no significant association between gender and diabetic nephropathy with P-value (0.263). (**Table 4**)

Table 4: The association between gender and prevalence of diabetic nephropathy

Gender	Nephropathy		No nephropathy		Total		Chi-square	P-value
	No.	%	No.	%	No.	%		
Male	26	20.5	42	33.0	68	53.5	1.252	0.263
Female	17	13.4	42	33.1	59	46.5		
Total	43	33.9	84	66.1	127	100		

Chi-square test used for statistical significant, level of significant is 0.05.

In our study result shows the diabetic patients had hypertension were (40.9%) and diabetic patients hadn't hypertension were (59.1%), the duration of DM is divided into 4 groups as following (< 5),(5-10),(11-15),and(>15) years. (**Table 5**).

Table 5: Distribution of study population according to clinical characteristics

Characteristic	Frequency	Percentage	
Hypertension in diabetes patients	Yes	52	40.9
	No	75	59.1
	Total	127	100
Duration of diabetes	< 5	53	41.7
	5-10	39	30.7
	11-15	17	13.4
	>15	18	14.2
	Total	127	100

The results showed that there is significant association between diabetic nephropathy and duration of DM with P-value(0.000), most common in patients with duration 5-10 years, (12.6%). (**Table 6**)

Table 6: The association between diabetic nephropathy and duration of DM patients

Duration of DM (Years)	Nephropathy		No nephropathy		Total		Chi-square	P-value
	No.	%	No.	%	No.	%		
< 5	8	6.3	45	35.4	53	41.7	21.07	0.000*
5-10	16	12.6	23	18.1	39	30.7		
11-15	6	4.7	11	8.7	17	13.4		
>15	13	10.3	5	3.9	18	14.2		
Total	43	33.9	84	66.1	127	100		

Chi-square test used for statistical significant, level of significant is 0.05.

We found, from the results, that the prevalence of diabetic nephropathy in type 2 DM patients who suffered from hypertension is (21.3%). While the prevalence of diabetic nephropathy in type 2 DM patients not suffered from hypertension is (12.6%), and there is significant association between diabetic nephropathy and hypertension with P-value (0.001). (**Table 7**)

Table 7: The association between diabetic nephropathy and hypertension

Hypertension in diabetic patients	nephropathy		No nephropathy		Total		Chi-square	P-value
	No.	%	No.	%	No.	%		
Yes	27	21.3	25	19.6	52	40.9	12.831	0.001*
No	16	12.6	59	46.5	75	59.1		
Total	43	33.9	84	66.1	127	100		

Chi-square test used for statistical significant, level of significant is 0.05.

The albumin found in urine in three forms; normalalbuminuria < 30 mg\24 hour collection of urine sample, microalbuminuria 30-300 mg\24 hour collection of urine sample, macroalbuminuria > 300 mg\24 hour, the results of this study showed the following; normalalbuminuria, microalbuminuria and macroalbuminuria (66.1%), (33.9%) and (0%) respectively. (**Table 8**)

Table 8: The results of albuminuria investigation among type 2 DM patients

Albuminuria	Frequency	Percentage	Mean	Standard deviation
< 30	84	66.1	22.51	14.637
30-300	43	33.9		
> 300	0	0		
Total	127	100		

In our study, the level of serum creatinine in all type 2 DM patients was normal. (**Table 9**)

Table 9: The relationship between serum creatinine and diabetic nephropathy

Serum creatinine	Mean	Standard deviation	Chi-square	P-value
	0.65	0.22	7.381	0.598

Chi-square test used for statistical significant, level of significant is 0.0

Discussion

This study analyzes prevalence of diabetic nephropathy in type 2 diabetic patients who attended to health centers in Mukalla City, Yemen. The prevalence of diabetic nephropathy among type2-diabetic patients in our study was 33.9%; (33.9% had microalbuminuria and 0% had macroalbuminuria), which is similar to the study done in Sana'a City Yemen in 2011-2012(33.6%) and Bahrain in 2006 (27.9%),[19,18] but lower than the study done in Oman in 2010-2011 (42.5%) and Egypt in 2011-2012 (47%), [16,21] and its higher than study done in Iraq in 2013(16.1%) and Saudi Arabia in 2013(10.8%),[13,22] the variation in prevalence rates is probably due to differences in diagnostic criteria, the stage of the disease, the method of assessment and ethnicity.[23]. The increased prevalence of diabetic nephropathy in type 2 DM could be explained by hyperglycemia of diseases,[24,25]in

addition to genetic predisposition and other associated risk factors namely male gender, diabetic duration,[25] hypertension, obesity and dyslipidemia.[25,26]

In this study there is no association between diabetic nephropathy and age of participants with p-value (0.427) this result was supported by study done in India which found no association between diabetic nephropathy and age with p-value (0.6),[27] however is in contrast with study done in Sana'a city which found that there is an association between diabetic nephropathy and age with p-values (0.002).[19]. We found the common age affected by nephropathy was (51-60), followed by (40-50), and (>60) years, which the percentage of diabetic nephropathy was (15%), (12.6 %) and (6.3%) respectively. Which difference with study done in Oman the common age group was (40-50),(50-60),and (>60) years respectively.[16] In another study done in India the common age groups affected to nephropathy was (45-60), followed by (>60),and (\leq 45) years, the percentage of diabetic nephropathy in these age groups was (21%), (12%) and (8%)respectively.[27].

The second factor in our study which shown no association with diabetic nephropathy is gender with p-value (0.263), this result was supported by study done in India with p-value (0.754).[27] Whereas in Malaysia study, Singapore study showed association between gender and diabetic nephropathy with p-value(<0.001),(0.022)..respectively.[28,29] In our study males patients were more affected by diabetic nephropathy than females, the prevalence of diabetic nephropathy in males was (53.5%) and in females was (46.5%). Which was in accordance with study done in Sana'a city,[30] while in another study in Malaysia prevalence of diabetic nephropathy was (44.2% and 55.8%) in male and female respectively.[28]

In our study two factors were found to affect the development of diabetic nephropathy, these are hypertension and duration of DM, the prevalence of hypertension in type 2 DM was (40.9%), of these (21.3%) had diabetic nephropathy, so there was association between diabetic nephropathy and hypertension with p-value (0.001), our study supported by studies in Kuwait, Bahrain, and Sana'a City [14,18,19], which in these studies association between diabetic nephropathy and hypertension was found with p-value (0.0001),($<$ 0.001) and (0.0001), respectively.

The mechanism contributing to diabetic nephropathy dedication of the blood pressure has been shown to be clearly important and powerful intervention, it showed that reduction of blood pressure is associated with decreased progression of diabetic nephropathy,[30] because high blood pressure accelerated the progressive increase in albumin level in patient with type 2 DM who had initially normal albumin and accelerated the loss of renal function in those with overt nephropathy.[31] Also we found there is a significant association between diabetic nephropathy and duration of DM with p-value(0.000), this result was supported by studies in Kuwaiti, Malaysia and Singapore, with p-value(0.001),($<$ 0.001),and(0.021) respectively,[14,28,29] and in contrast with study done in Saudi Arabia found there was no association between microalbuminuria and duration of DM with p-value(0.128)[22] Fortunately, in our study all nephropathy patients didn't have macroalbuminuria (albuminuria >300 mg\24urine collection) which similar to studies done in United Arab Emirates, Saudi Arabia and Tunisia.[15,32,33] however these results are differ from studies' done in Kuwait, Bahrain and Sana'a City,[14,18,19], which reported the rate of macroalbuminuria (16.2%, 5.8% and 12.4%,) respectively. The presence of excess urinary albumin excretion indicates the increased transcapillary escape rate of albumin and therefore a marker of microvascular disease, it's independent predictor of progressive renal disease, atherosclerotic disease, cardiovascular mortality and a valuable marker for the management of type 2 diabetes patients,[34] the variation between our study and other studies maybe due to stages of disease as well as in our study we used of 24 hour urine collection sample to assess microalbuminuria while in other studies a random urine sample for assessment of microalbuminuria was used. We found that all type 2 diabetic patients had normal level of serum creatinine with p-value (0.598) comparable to study done in Sana'a city Yemen 2011-2012 which

showed an association between diabetic nephropathy and serum creatinine with p-value (0.01), [19] this difference is due to that in our study early nephropathy patients have microalbuminuria only.

5. Conclusions

The prevalence of diabetic nephropathy among Type 2 DM patients was high. In respect of duration of DM, diabetic patients (5-10 years) and diabetic patients with hypertension were at high risk to develop diabetic nephropathy, while no statistically significant association between diabetic nephropathy with age and gender.

Microalbuminuria test detected of diabetic nephropathy when serum creatinine normal, so microalbuminuria test is more reliable to detecting early stages of diabetic nephropathy.

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